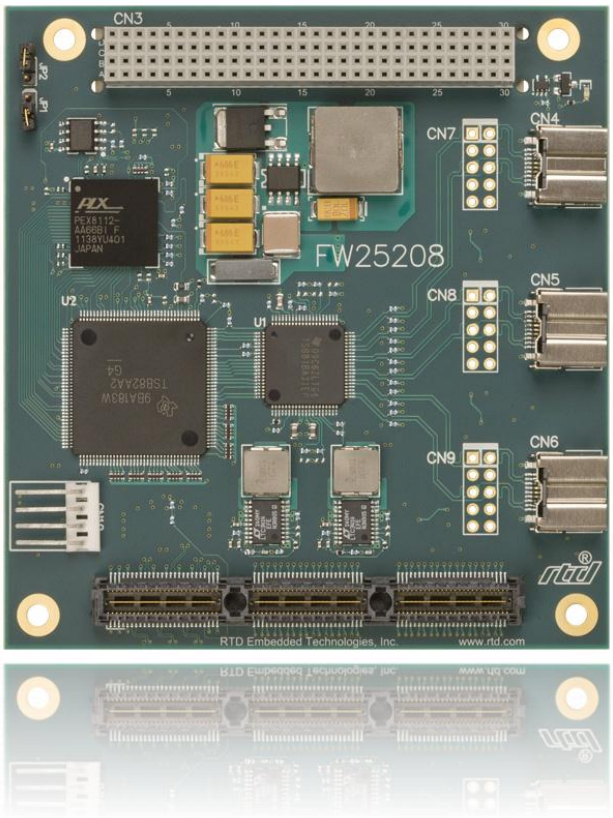
FW25208 and FW35208

PCI Express IEEE-1394

User's Manual

BDM-610020098 Rev. B



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Revision History

Rev A	Initial Release
Rev B	Updated IDAN picture

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Failure to follow the instructions found in this manual may result in damage to the product described in this manual, or other components of the system. The procedure set forth in this manual shall only be performed by persons qualified to service electronic equipment. Contents and specifications within this manual are given without warranty, and are subject to change without notice. RTD Embedded Technologies, Inc. shall not be liable for errors or omissions in this manual, or for any loss, damage, or injury in connection with the use of this manual.

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1 Introduction

1.1 Product Overview

The FW25208 and FW35208 are RTD peripheral modules that provide high performance serial bus communication compatible with FireWire™, iLINK™, and SB1394™ implementation of IEEE STD-1394b. Three independent channels support 100/200/400/800 Mb/s on each channel. The board is equipped with a 1394b bilingual connector for universal integration with both 1394a and 1394b devices. Each port is overcurrent protected.

1.2 Board Features

The following sections describe the major features of the FW25208 FireWire communication module.

- General Features
  - PCI Express (PCIe) x1 Upstream Interface to CPU
  - 3 independent channels
  - 3 universal 1394b bilingual connectors, which support connections to both 1394a and 1394b devices
  - Support for 100/200/400/800 Mb/s on each channel
  - Auto-resetting current limit on each channel
  - FireWire™, iLINK™, and SB1394™ implementation of IEEE STD-1394b
- Software
  - Uses standard OHCI FireWire drivers built into modern operating systems
  - FireWire interfaces natively supported under:
    - Windows 98 and 2000 (1394a transfer rates only)
    - Windows XP
    - Windows 7
    - Linux 2.4 and 2.6 kernels via open source driver
    - Windows CE 5.0 (1394a transfer rates only)

1.3 Ordering Information

The FW25208 is available with the following options:

Table 1: Ordering Options

Part Number	Description
FW25208HR	PCI/104-Express FireWire™ Module (with pass-through PCI)
FW35208HR	PCIe/104 FireWire™ Module (without pass-through PCI)
IDAN-FW25208HR	PCI/104-Express FireWire™ Module in IDAN enclosure
IDAN-FW35208HR	PCIe/104 FireWire™ Module in IDAN enclosure

Throughout this document, FW25208 refers to both the FW25208 and F35208 unless otherwise noted.

The Intelligent Data Acquisition Node (IDAN™) building block can be used in just about any combination with other IDAN building blocks to create a simple but rugged 104™ stack. This module can also be incorporated in a custom-built RTD HiDAN™ or HiDANplus High Reliability Intelligent Data Acquisition Node. Contact RTD sales for more information on our high reliability systems.

1.4 Contact Information

1.4.1 Sales Support

For sales inquiries, you can contact RTD Embedded Technologies sales via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: sales@rtd.com

1.4.2 Technical Support

If you are having problems with you system, please try the steps in the Troubleshooting section of this manual.

For help with this product, or any other product made by RTD, you can contact RTD Embedded Technologies technical support via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: techsupport@rtd.com

2 Specifications

2.1 Operating Conditions

Table 2: Operating Conditions

Symbol	Parameter	Test Condition	Min	Max	Unit
V_{cc5}	5V Supply Voltage		4.75	5.25	V
V_{cc3}	3.3V Supply Voltage		n/a	n/a	V
V_{cc12}	12V Supply Voltage		n/a	n/a	V
V_{cc-12}	-12V Supply Voltage		n/a	n/a	V
T_a	Operating Temperature		-40	+85	C
T_s	Storage Temperature		-55	+125	C
RH	Relative Humidity	Non-Condensing	0	90%	%
MTBF	Mean Time Before Failure	Telcordia Issue 2 30°C, Ground benign, controlled		TBD	Hours

2.2 Electrical Characteristics

Table 3: Electrical Characteristics

Symbol	Parameter	Test Condition	Min	Max	Unit
P_d	Power Dissipation	V_{cc5} = 5.0V, I_{PORT} = 0A		1.0	W
I_{cc5}	5V Input Supply Current	Active, Board only		200	mA
V_{OUT12}	12V Output Supply Voltage	At FireWire connector	-13.2	-10.8	V
I_{OUT12}	12V Output Supply Current	Total for all ports		2.0	A
I_{PORT}	Current Limit per port		1.0	2.0	A
PCIe Bus					
	Differential Output Voltage		0.8	1.2	V
	DC Differential TX Impedance		95.2	116.9	Ω
	Differential Input Voltage		0.175	3.3	V
	DC Differential RX Impedance		92.7	115.8	Ω
	Electrical Idle Detect Threshold		61	173	mV

3 Board Connection

3.1 Board Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your board in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the board at the edges, and do not touch the components or connectors. Handle the board in an antistatic environment, and use a grounded workbench for testing and handling of your hardware.

3.2 Physical Characteristics

- Weight: Approximately 82 g (0.18 lbs.)
- Dimensions: 90.17 mm L x 95.89 mm W (3.550 in L x 3.775 in W)

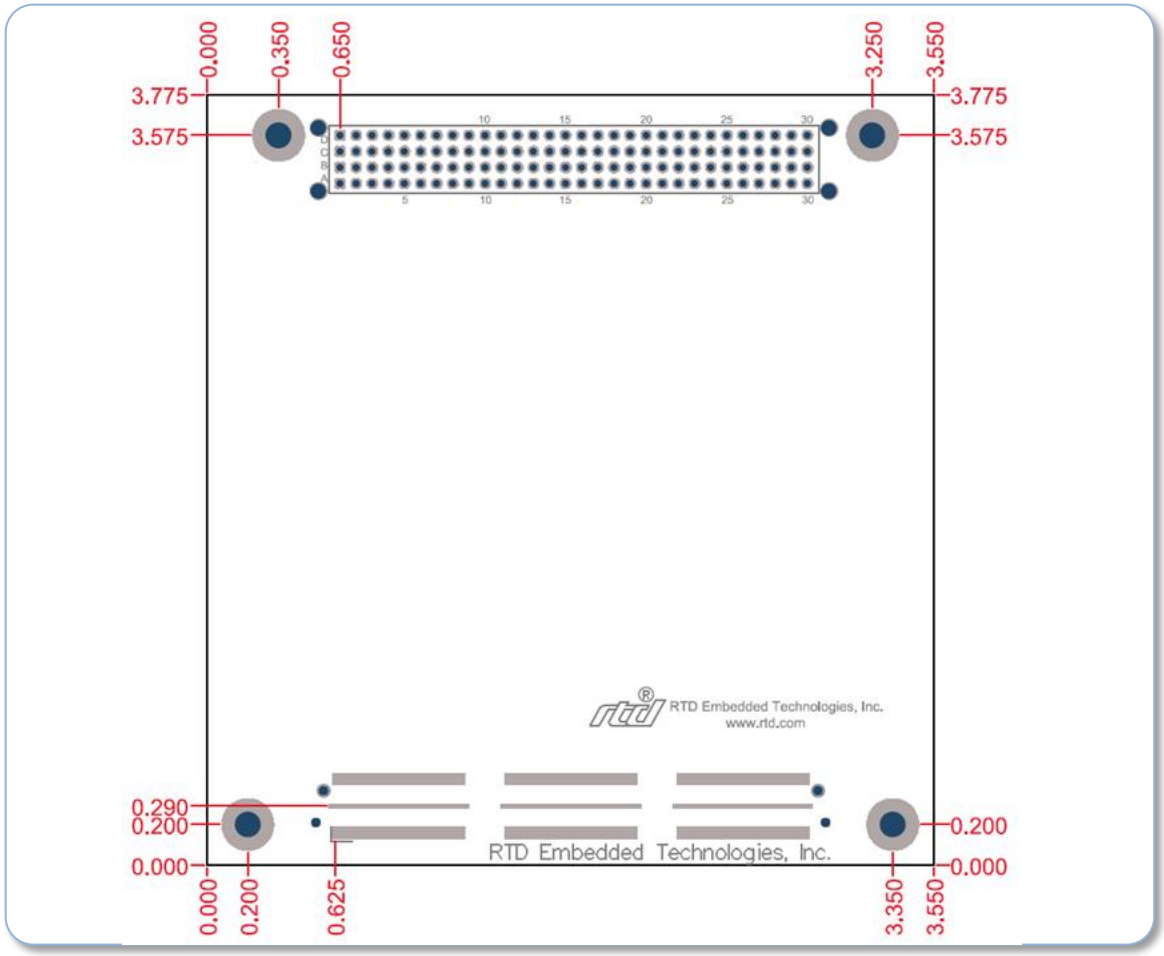


Figure 1: Board Dimensions

3.3 Connectors and Jumpers

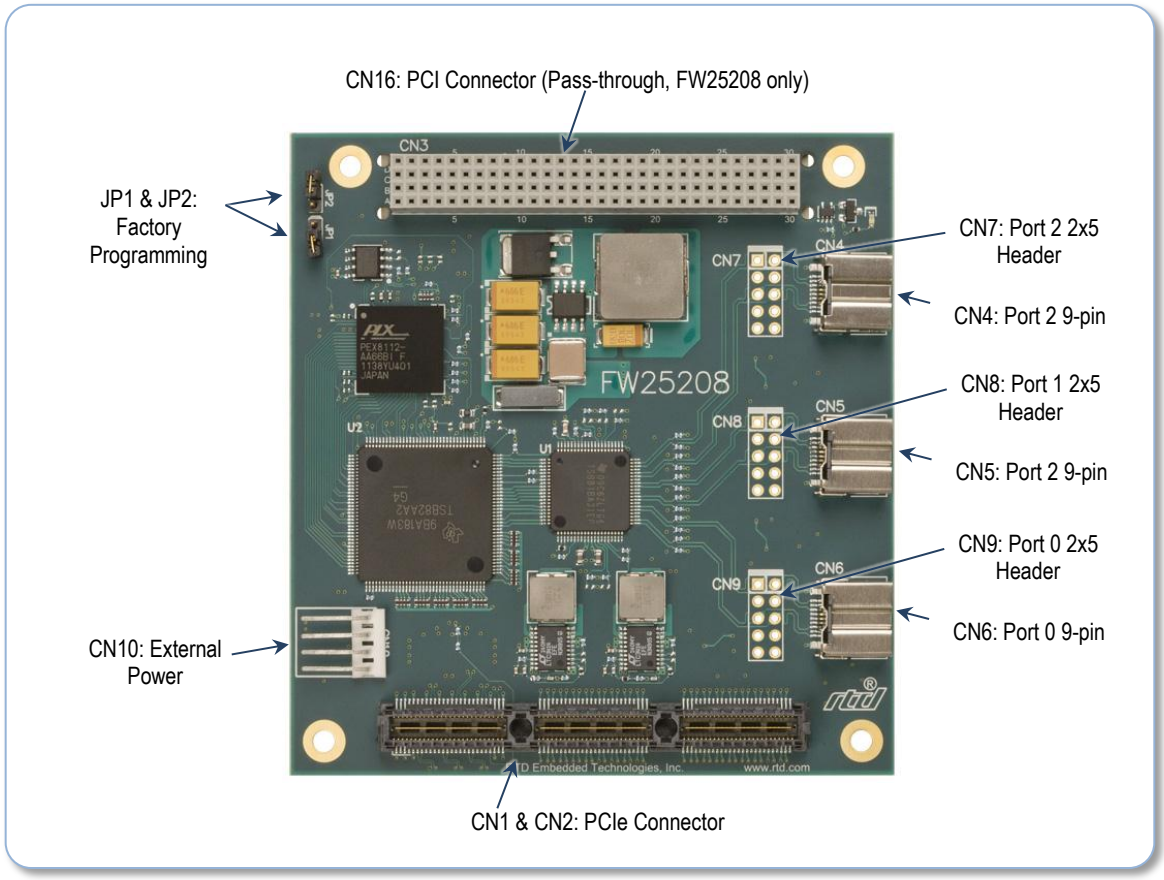


Figure 2: Board Connections

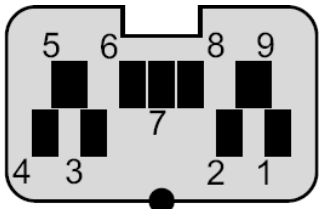
3.3.1 External I/O Connectors

CN4, CN5, and CN6: FireWire 9-pin Bilingual Connectors

CN4, CN5, and CN6 are FireWire 9-pin connectors. They are Bilingual, and can be used for IEEE-1394a or IEEE-1394b signaling. The pin assignments for this connector are shown below.

Table 4: FireWire 9-pin Connector

Pin	Signal	Function
4	TPA+	Twisted Pair A+
3	TPA–	Twisted Pair A–
5	TPR(A)	Ground, Twisted Pair A
9	TPR(B)	Ground, Twisted Pair B
2	TPB+	Twisted Pair B+
1	TPB–	Twisted Pair A–
8	SGND	Shield Ground
6	VCC	+12 V
Shield	GND	Ground
10	GND	Ground



CN7, CN8, and CN9: FireWire 2x5 Header

CN7, CN8, and CN9 are 2x5 0.1" headers. They are Bilingual, and can be used for IEEE-1394a or IEEE-1394b signaling. These connectors are not populated on the standard boards, and are generally only used for systems where the standard connector is not practical. The pin assignments for this connector are shown below.

Table 5: FireWire 2x5 Header

Pin	Signal	Function
1	TPA+	Twisted Pair A+
2	TPA–	Twisted Pair A–
3	TPR(A)	Ground, Twisted Pair A
4	TPR(B)	Ground, Twisted Pair B
5	TPB+	Twisted Pair B+
6	TPB–	Twisted Pair A–
7	SGND	Shield Ground
8	VCC	+12 V
9	GND	Ground
10	GND	Ground

3.3.2 BUS CONNECTORS

CN1 (Top) & CN2 (Bottom): PCIe Connector

The PCIe connector is the connection to the system CPU. The position and pin assignments are compliant with the *PCI/104-Express Specification*. (See PC/104 Specifications on page 19)

The FW25208 is a "Universal" board, and can connect to either a Type 1 or Type 2 PCIe/104 connector.

CN16: PCI Connector (FW25208 only)

The PCI connector is pass-through. The only electrical connections to the board are power and ground. The position and pin assignments are compliant with the *PCI/104-Express Specification*. (See PC/104 Specifications on page 19)

3.3.3 JUMPERS

Jumpers JP1 and JP2 are for factory use only.

3.4 Steps for Installing

1. Always work at an ESD protected workstation, and wear a grounded wrist-strap.
2. Turn off power to the PC/104 system or stack.
3. Select and install stand-offs to properly position the module on the stack.
4. Remove the module from its anti-static bag.
5. Check that pins of the bus connector are properly positioned.
6. Check the stacking order; make sure all of the busses used by the peripheral cards are connected to the cpuModule.
7. Hold the module by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
8. Gently and evenly press the module onto the PC/104 stack.
9. If any boards are to be stacked above this module, install them.
10. Attach any necessary cables to the PC/104 stack.
11. Re-connect the power cord and apply power to the stack.
12. Boot the system and verify that all of the hardware is working properly.

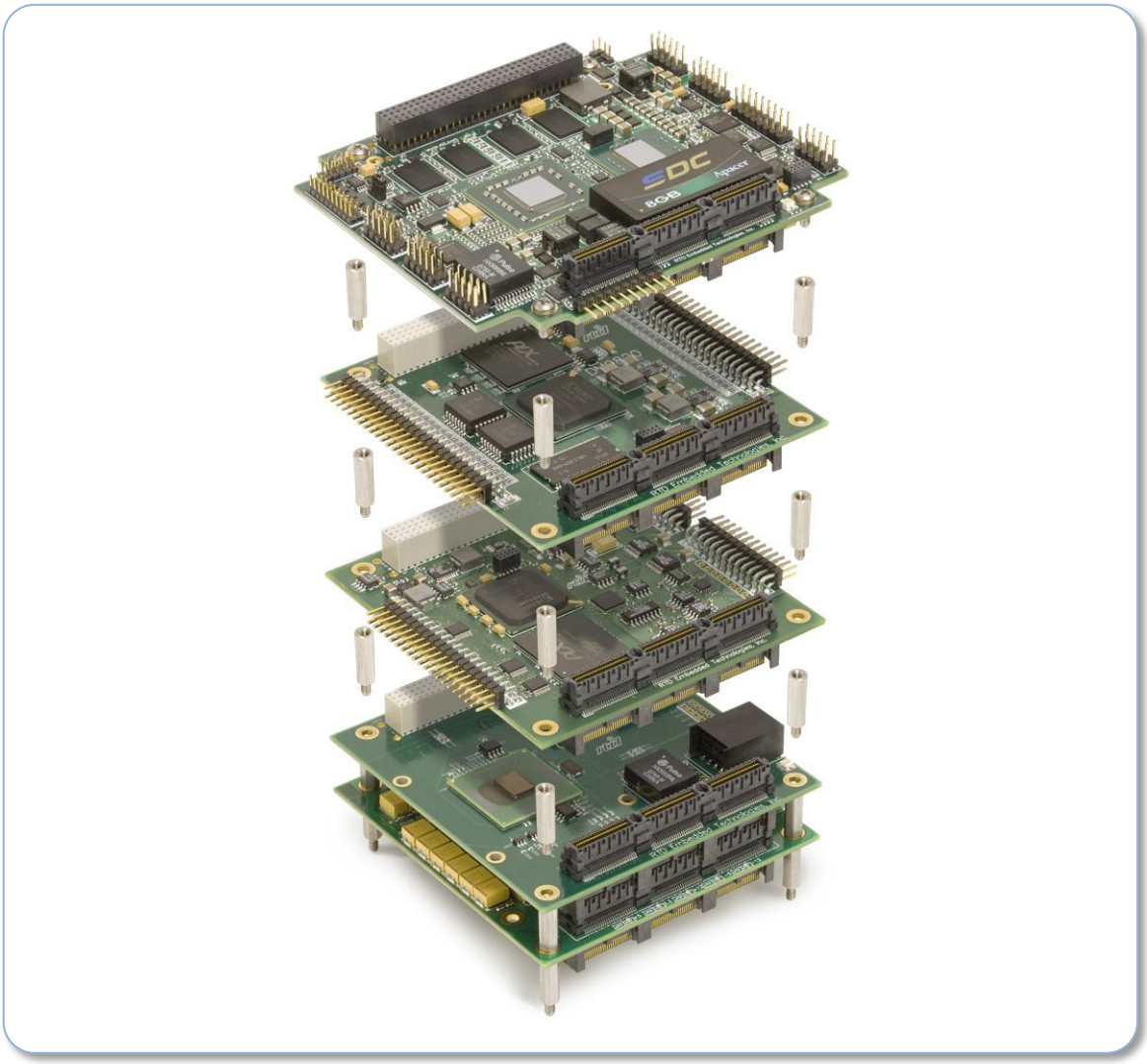


Figure 3: Example 104™ Stack

4 IDAN Connections

4.1 Module Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your module in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the module by the aluminum enclosure, and do not touch the components or connectors. Handle the module in an antistatic environment, and use a grounded workbench for testing and handling of your hardware.

4.2 Physical Characteristics

- Weight: Approximately 0.21 Kg (0.46 lbs.)
- Dimensions: 151.972 mm L x 129.978 mm W x 16.993 mm H (5.983 in L x 5.117 in W x 0.669 in H)

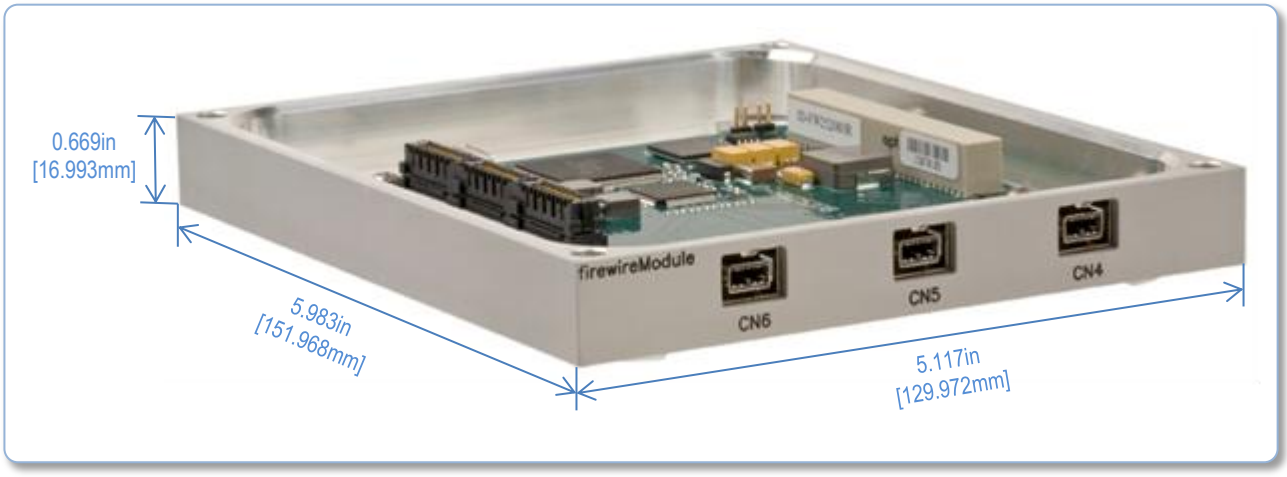


Figure 4: IDAN Dimensions

4.3 Connectors

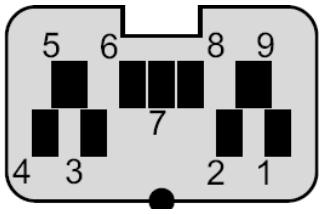
4.3.1 External I/O Connectors

CN4, CN5, and CN6: FireWire 9-pin Bilingual Connectors

CN4, CN5, and CN6 are FireWire 9-pin connectors. They are Bilingual, and can be used for IEEE-1394a or IEEE-1394b signaling. The pin assignments for this connector are shown below.

Table 6: FireWire 9-pin Connector

Pin	Signal	Function
4	TPA+	Twisted Pair A+
3	TPA–	Twisted Pair A–
5	TPR(A)	Ground, Twisted Pair A
9	TPR(B)	Ground, Twisted Pair B
2	TPB+	Twisted Pair B+
1	TPB–	Twisted Pair A–
8	SGND	Shield Ground
6	VCC	+12 V
Shield	GND	Ground
10	GND	Ground



4.3.2 Bus Connectors

CN1 (Top) & CN2 (Bottom): PCIe Connector

The PCIe connector is the connection to the system CPU. The position and pin assignments are compliant with the *PCI/104-Express Specification*. (See PC/104 Specifications on page 19)

The FW25208 is a "Universal" board, and can connect to either a Type 1 or Type 2 PCIe/104 connector.

CN16: PCI Connector (FW25208 only)

The PCI connector is pass-through. The only electrical connections to the board are power and ground. The position and pin assignments are compliant with the *PCI/104-Express Specification*. (See PC/104 Specifications on page 19)

4.4 Steps for Installing

1. Always work at an ESD protected workstation, and wear a grounded wrist-strap.
2. Turn off power to the IDAN system.
3. Remove the module from its anti-static bag.
4. Check that pins of the bus connector are properly positioned.
5. Check the stacking order; make sure all of the busses used by the peripheral cards are connected to the cpuModule.
6. Hold the module by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
7. Gently and evenly press the module onto the IDAN system.
8. If any boards are to be stacked above this module, install them.
9. Finish assembling the IDAN stack by installing screws of an appropriate length.
10. Attach any necessary cables to the IDAN system.
11. Re-connect the power cord and apply power to the stack.
12. Boot the system and verify that all of the hardware is working properly.

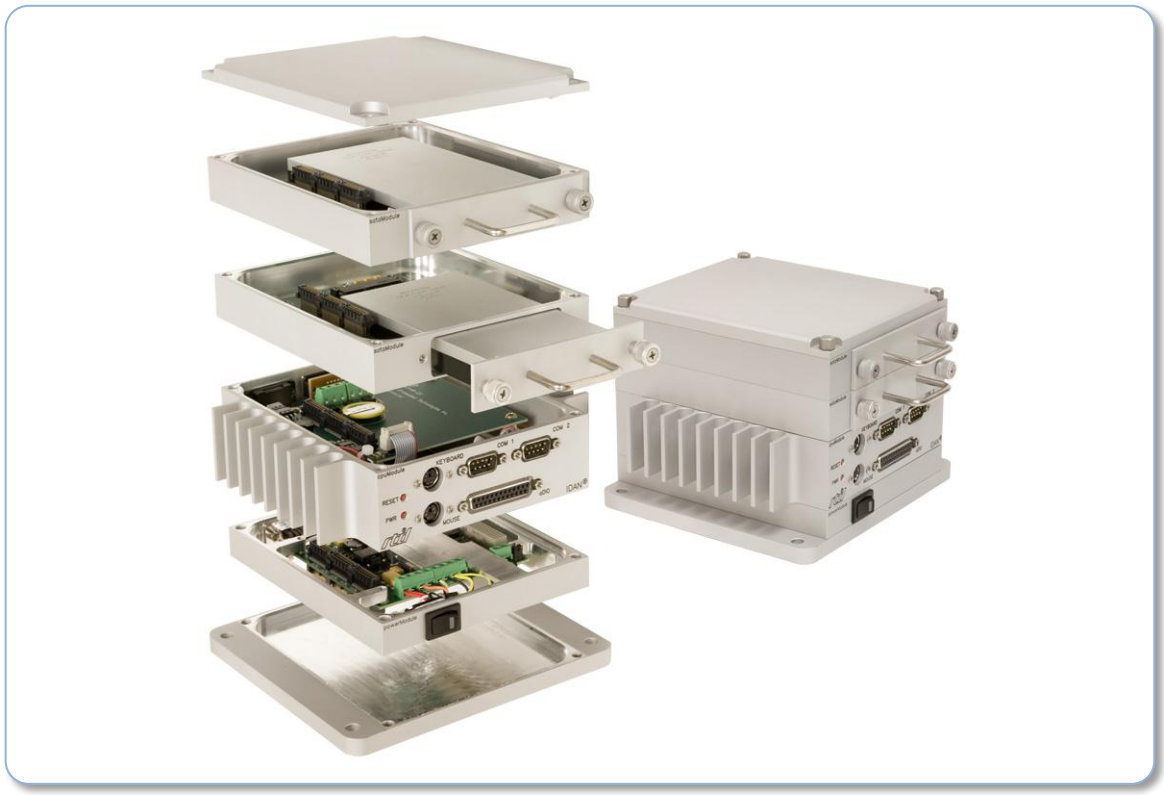


Figure 5: Example IDAN System

5 Functional Description

5.1 Block Diagram

The Figure below shows the functional block diagram of the FW25208. The various parts of the block diagram are discussed in the following sections.

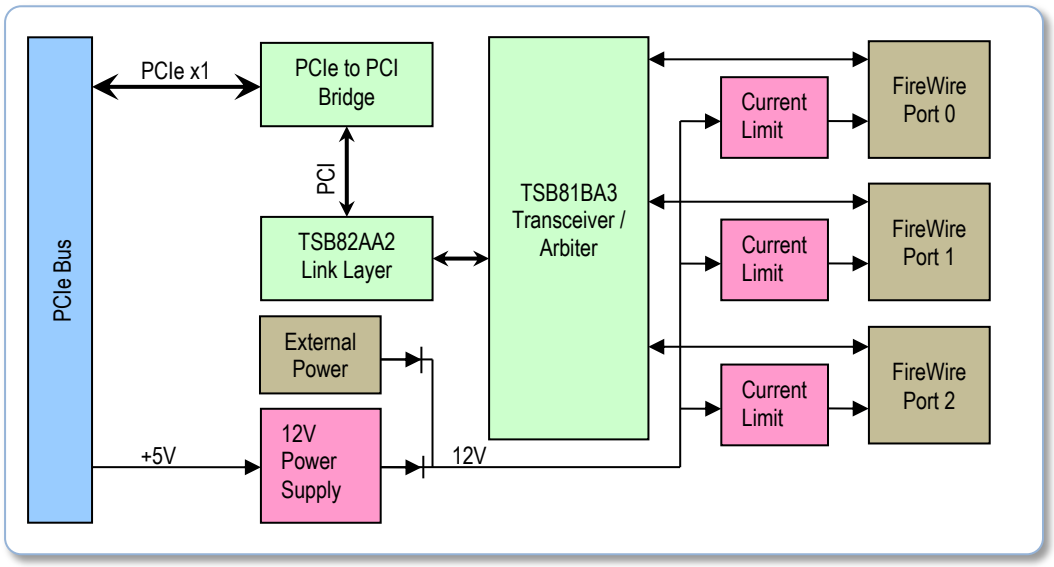


Figure 6: FW25208 Block Diagram

5.2 Port Current Limit

The FW25208 has three current protection circuits, one for each 1394 bilingual connector. FireWire communication provides +12 V through the cable to power devices on the receiving end. If any device attached to the FW25208 draws more than the rated current, power to the port will be shut off. The circuit will retry until the fault has cleared.

5.3 External Power

The FW25208 has an onboard power supply that provides +12 V to each bilingual connector. This power supply is only rated for 2A. If more power than the rated 1 A per connector is required, connector CN10 can be used to supply power externally.

5.4 Cable Pin Assignments

The following table lists the connections required to build a cable that connects the FW25208 to standard FireWire devices. To use this table, select the type of connector you using on the FW25208 from the "Left Side" columns, and the type of connector for the device that you are connecting to from the "Right Side" columns. Each row of the table then indicates a wire from the left side connector to the right side connector.

Table 7: FireWire Cable Pin Assignments

Left Side				Right Side					
FireWire 9-pin	2x5 0.1"	DB9	Signal Name	Signal Name	DB9	2x5 0.1"	FireWire 4-pin	FireWire 6-pin	FireWire 9-pin
4	1	1	TPA+	TPB+	3	5	2	4	2
3	2	6	TPA–	TPB–	8	6	1	3	1
5	3	2	TPR(A)	TPR(B)	7	4	Shield	2	9
2	5	3	TPB+	TPA+	1	1	4	6	4
1	6	8	TPB–	TPA–	6	2	3	5	3
9	4	7	TPR(B)	TPR(A)	2	3	Shield	2	5
8	8	9	VCC	VCC	9	8	n.c.	1	8
6	9, 10	5	GND	GND	5	9, 10	Shield	2	6
Shield	7	4	SGND	SGND	4	7	Shield	Shield	Shield

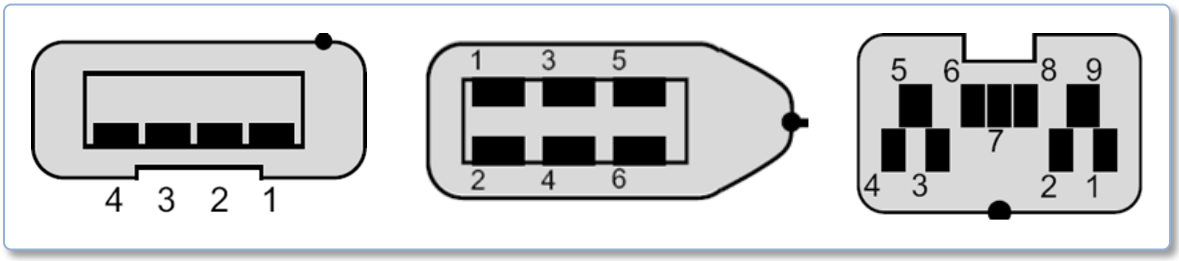


Figure 7: FireWire 4-pin, 6-pin, and 9-pin Connectors (looking into cable end)

6 Troubleshooting

If you are having problems with your system, please try the following initial steps:

- **Simplify the System** – Remove modules one at a time from your system to see if there is a specific module that is causing a problem. Perform you troubleshooting with the least number of modules in the system possible.

- **Swap Components** – Try replacing parts in the system one at a time with similar parts to determine if a part is faulty or if a type of part is configured incorrectly.

If problems persist, or you have questions about configuring this product, contact RTD Embedded Technologies via the following methods:

Phone: +1-814-234-8087
E-Mail: techsupport@rtd.com

Be sure to check the RTD web site (http://www.rtd.com) frequently for product updates, including newer versions of the board manual and application software.

7 Additional Information

7.1 PC/104 Specifications

A copy of the latest PC/104 specifications can be found on the webpage for the PC/104 Embedded Consortium:

www.pc104.org

7.2 PCI Express Specification

A copy of the latest PCI Express specifications can be found on the webpage for the PCI Special Interest Group:

www.pcisig.com

7.3 IEEE-1394 / FireWire Specification

A copy of the latest IEEE-1394 specification can be found on the webpage for IEEE:

www.ieee.org

8 Limited Warranty

RTD Embedded Technologies, Inc. warrants the hardware and software products it manufactures and produces to be free from defects in materials and workmanship for one year following the date of shipment from RTD Embedded Technologies, Inc. This warranty is limited to the original purchaser of product and is not transferable.

During the one year warranty period, RTD Embedded Technologies will repair or replace, at its option, any defective products or parts at no additional charge, provided that the product is returned, shipping prepaid, to RTD Embedded Technologies. All replaced parts and products become the property of RTD Embedded Technologies. Before returning any product for repair, customers are required to contact the factory for a Return Material Authorization (RMA) number.

This limited warranty does not extend to any products which have been damaged as a result of accident, misuse, abuse (such as: use of incorrect input voltages, improper or insufficient ventilation, failure to follow the operating instructions that are provided by RTD Embedded Technologies, “acts of God” or other contingencies beyond the control of RTD Embedded Technologies), or as a result of service or modification by anyone other than RTD Embedded Technologies. Except as expressly set forth above, no other warranties are expressed or implied, including, but not limited to, any implied warranties of merchantability and fitness for a particular purpose, and RTD Embedded Technologies expressly disclaims all warranties not stated herein. All implied warranties, including implied warranties for merchantability and fitness for a particular purpose, are limited to the duration of this warranty. In the event the product is not free from defects as warranted above, the purchaser's sole remedy shall be repair or replacement as provided above. Under no circumstances will RTD Embedded Technologies be liable to the purchaser or any user for any damages, including any incidental or consequential damages, expenses, lost profits, lost savings, or other damages arising out of the use or inability to use the product.

Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, and some states do not allow limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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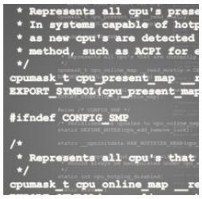

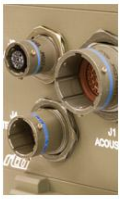
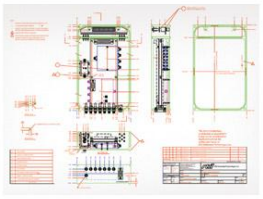

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